

## **Project Description**

### **Modeling, Estimation, and Monitoring of Force Transmission in Wind Turbines**

Recent studies by the Department of Energy suggest that wind energy could make up as much as 20% of total U.S. power generation by 2030. By better understanding the load transmission in wind turbines, subsequent improvements in design could result in more efficient turbines and reduced maintenance costs. The objective of this study is twofold. First, a low-cost monitoring system to assess the condition of the bolted joint connections used to attach the blades to the hub is devised in order to characterize the force transmission into the hub and to detect when bolt loosening for in-service wind turbines. A section of the CX100 blade is used for the joint monitoring study. Second, a method to estimate the tip deflection of the blade is developed to better understand the dynamic loads acting on the rotor hub. A one-meter-long blade is used to estimate the tip deflection under laboratory conditions. Using the results from these tests, this study demonstrates how a better understanding of load transmission from the blade to the hub may be achieved.